

WHAT IS CLAIMED IS:

1. An ultrasound diagnosis apparatus comprising:
 - an ultrasound probe which includes ultrasound transducers which transmit and receive ultrasound waves to and from an object to be examined;
 - an ultrasound transmission/reception unit which transmits and receives an ultrasound beam by driving the ultrasound transducers;
 - a physiological characteristic the object image data generating unit which generates physiological characteristic image data corresponding to at least one time phase, which is used to image at least one physiological characteristic of the object, on the basis of a reception signal received by the ultrasound transmission/reception unit;
 - a memory which stores the physiological characteristic image data;
 - an LOI (Line Of Interest) setting unit which sets an LOI at an arbitrary position on a physiological characteristic image displayed on the basis of the physiological characteristic image data;
 - an M-mode image generating unit which reads out the physiological characteristic image data corresponding to the LOI from the memory and generates an arbitrary M-mode image as an M-mode image representing a temporal change associated with the LOI;
 - a setting unit which sets a profile position by

using a cursor displayed on the arbitrary M-mode image;

a profile generating unit which generates a temporal profile of the arbitrary M-mode image at the profile position and a spatial profile of the arbitrary M-mode image which is associated with a line segment including at least the LOI; and

a display unit which simultaneously displays the arbitrary M-mode image, the temporal profile, and the spatial profile.

2. An apparatus according to claim 1, wherein the cursor comprises a cross cursor which is constituted by a first straight line and a second straight line crossing the first straight line at a right angle, with the respective straight lines and an intersection point thereof moving on the arbitrary M-mode image in accordance with an instruction from an operator, and

the profile generating unit generates the temporal profile corresponding to a position of the first straight line, and generates the spatial profile corresponding to a position of the second straight line.

3. An apparatus according to claim 1, wherein the display unit places the temporal profile on the lower or upper side of the arbitrary M-mode image, and places the spatial profile on the right or left side of the arbitrary M-mode image.

4. An apparatus according to claim 1, wherein the display unit displays the ultrasound image, on which at least one of an LOI set on the physiological characteristic image and the profile position is identified, simultaneously with the arbitrary M-mode image, the temporal profile, and the spatial profile.

5. An apparatus according to claim 4, wherein the display unit displays a time phase of the ultrasound image and a time phase of the temporal profile in correspondence with each other.

6. An apparatus according to claim 4, wherein when a length of an LOI set on the ultrasound image changes over time, the display unit performs display upon controlling at least a length of an M-mode display axis corresponding to the LOI length to be constant.

7. An apparatus according to claim 1, wherein the physiological characteristic includes one of a strain amount of tissue, a strain ratio of tissue, a movement amount of the tissue, a movement velocity of at least one of the tissue or blood, and a correlation amount of the reception signal power.

8. An apparatus according to claim 1, wherein when the physiological characteristic image data includes at least two physiological characteristics, the M-mode image generating unit generates the arbitrary M-mode image associated with a designated one of the physiological characteristics.

9. An ultrasound diagnosis apparatus comprising:
an ultrasound probe which includes ultrasound
transducers which transmit and receive ultrasound waves
to and from an object to be examined;

5 an ultrasound transmission/reception unit which
transmits and receives an ultrasound beam by driving
the ultrasound transducers;

 a physiological characteristic image data
generating unit which generates physiological
10 characteristic image data corresponding to a plurality
of time phases, which are used to image a physiological
characteristic associated with a body of the object, on
the basis of a reception signal received by the
ultrasound transmission/reception unit;

15 a memory which stores the physiological
characteristic image data;

 an LOI setting unit which sets an LOI at an
arbitrary position on a physiological characteristic
image displayed on the basis of the physiological
20 characteristic image data;

 an M-mode image generating unit which reads out
the physiological characteristic image data
corresponding to the LOI from the memory and generates
an arbitrary M-mode image which is an M-mode image
25 indicating a temporal change associated with the LOI;

 a setting unit which sets a specific region whose
motion is to be tracked in a time-series manner and a

start time phase of tracking;

5 a specific region tracking unit which tracks
a time-series position of the specific region from
the start time phase by using the physiological
characteristic image data corresponding to said
plurality of time phases and acquires a tracking line
associated with the specific region;

10 a profile generating unit which generates a
temporal profile of the arbitrary M-mode image
associated with the tracking line; and

 a display unit which simultaneously displays the
arbitrary M-mode image and the temporal profile.

15 10. An apparatus according to claim 9, wherein the
physiological characteristic image data comprises at
least a movement velocity of tissue.

20 11. An apparatus according to claim 10, wherein
the specific region tracking unit performs an angle
correction for the movement velocity of the tissue in
consideration of a direction of the LOI and the
ultrasound transmission/reception direction, and
obtains a tracking line for a specific region on the
basis of a velocity component in the corrected
predetermined motion direction.

25 12. An apparatus according to claim 9, wherein the
display unit displays the tracking line on the
arbitrary M-mode image.

 13. An apparatus according to claim 9, wherein the

display unit simultaneously displays the LOI and the ultrasound image for recognizing at least one of the specific regions, together with the arbitrary M-mode image and the temporal profile.

5 14. An apparatus according to claim 13, wherein the display unit displays a time phase of the ultrasound image and a time phase of the temporal profile in correspondence with each other.

10 15. An apparatus according to claim 9, wherein the profile generating unit further generates a spatial profile of the arbitrary M-mode image associated with a line segment containing at least the LOI, and

15 the display unit simultaneously displays the arbitrary M-mode image, the temporal profile, and the spatial profile.

20 16. An apparatus according to claim 15, wherein the cursor moves on the arbitrary M-mode image displayed in accordance with an instruction from the operator, and comprises a first straight line and a second straight line crossing the first straight line at a right angle, and

25 the profile generating unit generates the temporal profile corresponding to a position of the first straight line, and generates the spatial profile corresponding to a position of the second straight line.

17. An apparatus according to claim 15, wherein the display unit displays a marker at a position on the temporal profile which corresponds to the second straight line on the arbitrary M-mode image.

5 18. An apparatus according to claim 9, wherein the display unit displays the temporal profile on the lower or upper side of the arbitrary M-mode image.

19. An apparatus according to claim 9, wherein the display unit makes a display size of the temporal
10 profile substantially coincide with a display size of the arbitrary M-mode image.

20. An apparatus according to claim 9, which further comprises a selection unit which selects at least one physiological characteristic of a strain
15 amount of a tissue, a movement amount of the tissue, a movement velocity of the tissue, and a luminance, and

in which the physiological characteristic includes one of a strain amount of tissue, a strain ratio of tissue, a movement amount of the tissue, a movement
20 velocity of at least one of the tissue or blood, and a correlation amount of the reception signal power.

21. An apparatus according to claim 9, which further comprises a selection unit which selects one of physiological characteristics when the physiological
25 characteristic image data includes at least two physiological characteristics, and

in which the M-mode image generating unit

generates the arbitrary M-mode image associated with the selected physiological characteristic.

22. An apparatus according to claim 9, which further comprises a biometric signal measuring unit
5 which measures a biometric signal waveform associated with the object, and

in which the display unit performs display upon making a display size of a time axis of the biometric signal waveform substantially coincide with a size of a
10 time axis of the arbitrary M-mode image.

23. An apparatus according to claim 9, wherein the M-mode image generating unit calculates an average value of a plurality of physiological characteristics associated with an area adjacent to the LOI, and
15 generates arbitrary M-mode image data of the specific region on the basis of the average value.

24. An ultrasound image display apparatus comprising:

a memory which stores physiological characteristic
20 image data corresponding to at least one time phase, which is obtained by imaging at least one physiological characteristic of an object to be examined, on the basis of an ultrasound signal received from the object;

an LOI (Line Of Interest) setting unit which sets
25 an LOI at an arbitrary position on a physiological characteristic image displayed on the basis of the physiological characteristic image data;

an M-mode image generating unit which reads out the physiological characteristic image data corresponding to the LOI from the memory, and generates an arbitrary M-mode image which is an M-mode image
5 representing a temporal change associated with the LOI;
a setting unit which sets a profile position by a cursor displayed on the arbitrary M-mode image;
a profile generating unit which generates a temporal profile of the arbitrary M-mode image at the
10 profile position and a spatial profile of the arbitrary M-mode image associated with a line segment containing at least the LOI; and
a display unit which simultaneously displays the arbitrary M-mode image, the temporal profile, and the
15 spatial profile.

25. An ultrasound image display apparatus comprising:

a memory which stores physiological characteristic image data corresponding to at least one time phase,
20 which is obtained by imaging at least one physiological characteristic of an object to be examined on the basis of an ultrasound signal received from the object;
an LOI (Line of Interest) setting unit which sets an LOI at an arbitrary position on a physiological
25 characteristic image displayed on the basis of the physiological characteristic image data;
an M-mode image generating unit which reads out

the physiological characteristic image data corresponding to the LOI from the memory, and generates an arbitrary M-mode image which is an M-mode image representing a temporal change associated with the LOI;

5 a setting unit which sets a specific region whose motion is to be tracked in a time-series manner and a start time phase of tracking by a cursor displayed on the arbitrary M-mode image;

10 a specific region tracking unit which tracks a time-series position of the specific region from the start time phase by using the physiological characteristic image data corresponding to said plurality of time phases and acquires a tracking line associated with the specific region;

15 a profile generating unit which generates a temporal profile of the arbitrary M-mode image associated with the tracking line; and

 a display unit which simultaneously displays the arbitrary M-mode image and the temporal profile.

20 26. An ultrasound image display method comprising:

 storing physiological characteristic image data corresponding to at least one time phase, which is obtained by imaging at least one physiological characteristic of an object to be examined on the basis of an ultrasound signal received from the object;

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 setting an LOI (Line Of Interest) at an arbitrary position on a physiological characteristic image

displayed on the basis of the physiological
characteristic image data;

reading out the physiological characteristic image
data corresponding to the LOI from the memory, and
5 generating an arbitrary M-mode image which is an M-mode
image representing a temporal change associated with
the LOI;

setting a profile position by a cursor displayed
on the arbitrary M-mode image;

10 generating a temporal profile of the arbitrary
M-mode image at the profile position and a spatial
profile of the arbitrary M-mode image associated with a
line segment containing at least the LOI; and

simultaneously displaying the arbitrary M-mode
15 image, the temporal profile, and the spatial profile.

27. An ultrasound image display method comprising:

storing physiological characteristic image data
corresponding to at least one time phase, which is
obtained by imaging at least one physiological
20 characteristic of an object to be examined on the basis
of an ultrasound signal received from the object;

setting an LOI (Line Of Interest) at an arbitrary
position on a physiological characteristic image
displayed on the basis of the physiological charac-
25 teristic image data;

reading out the physiological characteristic image
data corresponding to the LOI from the memory, and

generating an arbitrary M-mode image which is an M-mode image representing a temporal change associated with the LOI;

5 setting a specific region whose motion is to be tracked in a time-series manner and a start time phase of tracking by a cursor displayed on the arbitrary M-mode image;

10 tracking a time-series position of the specific region from the start time phase by using the physiological characteristic image data corresponding to said plurality of time phases and acquiring a tracking line associated with the specific region;

15 generating a temporal profile of the arbitrary M-mode image associated with the tracking line; and simultaneously displaying the arbitrary M-mode image and the temporal profile.

28. An ultrasound image display apparatus comprising:

20 a memory which stores physiological characteristic image data corresponding to at least one time phase, which is obtained by imaging at least one physiological characteristic of an object to be examined on the basis of an ultrasound signal received from the object;

25 an LOI (Line Of Interest) setting unit which sets a plurality of LOIs at arbitrary different positions on a physiological characteristic image displayed on the basis of the physiological characteristic image data;

an M-mode image generating unit which reads out the physiological characteristic image data corresponding to the respective LOIs from the memory, and generates a plurality of arbitrary M-mode images which are M-mode images representing temporal changes associated with the respective LOIs;

a setting unit which sets a profile position for said each arbitrary mode image by cursors displayed on the respective arbitrary M-mode images;

a profile generating unit which generates, for said each arbitrary mode image, a temporal profile of the arbitrary M-mode image at the profile position and a spatial profile of the arbitrary M-mode image associated with a line segment containing at least the LOI; and

a display unit which simultaneously displays the respective arbitrary M-mode images, the respective temporal profiles, and the respective spatial profiles.

29. An ultrasound image display apparatus comprising:

a memory which stores physiological characteristic image data corresponding to at least one time phase, which is obtained by imaging at least one physiological characteristic of an object to be examined on the basis of an ultrasound signal received from the object;

an LOI (Line Of Interest) setting unit which sets a plurality of LOIs at arbitrary different positions on

a physiological characteristic image displayed on the basis of the physiological characteristic image data;

an M-mode image generating unit which reads out the physiological characteristic image data corresponding to the respective LOIs from the memory, and generates a plurality of arbitrary M-mode images which are M-mode images representing temporal changes associated with the respective LOIs;

a setting unit which sets, for said each arbitrary mode image, a specific region whose motion is to be tracked in a time-series manner and a start time phase of tracking by a cursor displayed on said each arbitrary M-mode image;

a specific region tracking unit which tracks a time-series position of the specific region from the start time phase by using the physiological characteristic image data corresponding to said plurality of time phases and acquires a tracking line associated with the specific region for said each arbitrary M-mode image;

a profile generating unit which generates a temporal profile of the arbitrary M-mode image associated with the tracking line for said each arbitrary M-mode image; and

a display unit which simultaneously displays the respective arbitrary M-mode images and the respective temporal profiles.